Measurement of surface plasmon resonance intensity in thin film plasmonic sensors

Ciaran P. Moore[1,2]*, Aran N. Warren[1], Roshni S. Babu[1], Shaun H. Swan[1], and Gideon J. Gouws[1]

[1]*School of Engineering and Computer Science, Victoria University of Wellington, Wellington, New Zealand*
[2]*Electrical and Computer Engineering Department, University of Canterbury, Christchurch, New Zealand*

Email address of presenting author: ciaran.moore@vuw.ac.nz

Novel plasmonic sensors with applications in biosensing[1], microscopy[2] and lithography[3] have renewed interest in the fabrication of smooth, low loss Ag thin films[4]. Although the inclusion of seed layers[5,6] can lead to smoother Ag thin films, this comes at the cost of increased dielectric loss. As thin film plasmonic sensors are typically characterised by their reflectance spectra[7] and not the strength of the surface plasmon resonance that they produce, there is no established way to measure the competing effects of increased smoothness and higher loss.

To address this shortfall, we are developing an experimental characterization technique that unambiguously measures the intensity of surface plasmon resonance in thin film plasmonic sensors. This measurement gives a clear indication of the quality of the sensor, accounting for both the improvements in surface roughness and increases in dielectric loss introduced by seed layers. Our technique is based on an Ag thin film sensor in the Kretschmann configuration and coated with a fluorescent dye that responds to the intensity of evanescent modes excited by surface plasmon resonance at the metal-dye interface. We present spectrographic results for various thin film sensor configurations and discuss the mechanics that govern this characterisation technique.

References:

1. F. Long, A. Zhu, and H. Shi, *Sensors*, **2013**, *13*, 13928–13948.
2. J.L. Ponsetto et al., *ACS Nano*, **2017**, *11*, 5344–5350.
3. P. Chaturvedi et al., *Appl. Phys. Lett.*, **2010**, *96*, 043102.
4. H.R. Colenso et al., *Thin Solid Films*, **2018**, *656*, 68–74.
5. V.J. Logeeswaran et al., *Nano Lett.*, **2009**, *9,* 178–182.
6. N. Formica et al., *ACS Appl. Mater. Interfaces*, **2013**, *5*, 3048–3053.
7. B. Liedberg, C. Nylander and I. Lundstrom, *Sensors Actuators*, **1983**, *4*, 299–304.